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B I O M E

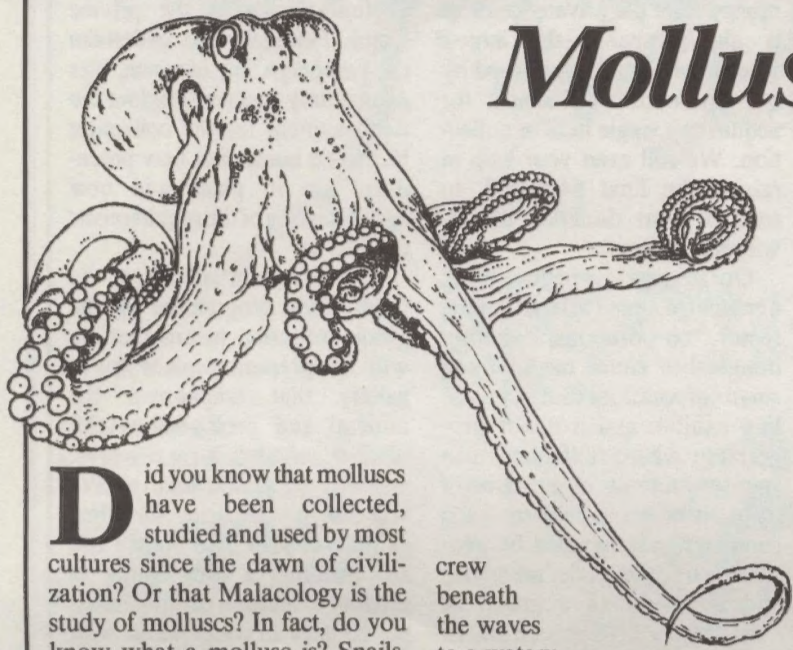
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Molluscan Fact and Fantasy



Did you know that molluscs have been collected, studied and used by most cultures since the dawn of civilization? Or that Malacology is the study of molluscs? In fact, do you know what a mollusc is? Snails, clams, squid, octopus and slugs, as molluscs are more commonly known, are the second largest group in the animal kingdom. It is estimated that there are between 50,000 and 100,000 different kinds of molluscs living today; in previous geological times there may easily have been twice this number.

Molluscs live on land as well as in the sea or fresh water. They are found all over the world in a wide variety of habitats, including tropical coral reefs, the depths of polar seas, jungle tree tops, desert springs, mountain peaks, caves, underground rivers, tide pools, lakes, rivers and streams, and even in your own backyard.

Molluscs come in every colour, shape and size imaginable. The largest living mollusc is the giant squid, which can grow to more than 16 m long and weigh close to 2000 kg. This creature also bears the distinction of being the world's largest living invertebrate. In legends, giant squid pluck terrified sailors from the decks of sailing ships or wrap their arms around hapless vessels, dragging vessel and

crew beneath the waves to a watery grave. Although legends contain a mix of fact and fantasy, the giant squid does command respect. Any sailor who has witnessed a battle between a giant squid and a sperm whale, or anyone who has ever been confronted by even one of a giant squid's 10 arms (each of which can be more than 6 m long!) will attest to the creature's awesome size and strength. One need not live in fear, however, for this bizarre mollusc is rarely seen. The giant squid is a solitary creature, believed to inhabit the deep waters of the open ocean, and rarely comes to the surface.

The world's largest living clam is the Indo-Pacific giant clam, which can weigh more than 250 kg and exceed 1 m in length. This mollusc has often been portrayed in movies and stories as a dangerous killer that feeds on humans. In reality the giant clam lies imprisoned in coral and feeds on algae that grow within its body

Octopus

cavity. Rather than being a voracious marauder of the deep, it is more often a victim, unable to escape or defend itself. The giant clam, although protected in many areas, is on the way to becoming a threatened species, largely because of loss of habitat and illegal harvest by poachers, who sell its flesh for food and its shell as a curiosity.

The world's largest snail is the Australian trumpet shell, which is often more than 0.50 m long. Snails may be the least impressive of molluscs in size, but they may be the most dangerous. Certain snails, commonly called cones because of their cone shape, produce a lethal venom, which they use to immobilize their prey while feeding on them. Cones eject their poison much they way a snake does and their tooth, like that of a snake, is very sharp and just as capable of piercing human skin. Only about five species of cones are known to possess a deadly sting, but all cones should be handled with care. Live cones should never be carried in a bathing suit pocket or tucked in a swimsuit or diving glove, and long forceps should always be used to handle them.

Shell collectors here in North America can relax; only a few species of cones, none of which are known to be poisonous, inhabit our waters. Collectors on Australia's Great Barrier Reef must be very cautious, however, for many beautiful cone species live there, and some are venomous. There you will also find a beautiful but venomous octopus. Your instant reaction would be to pick up this tiny creature to inspect more closely its incredible colour pattern of fluorescent blue rings on a mottled background. No matter how tempting, do not give in to the urge to pick it up. This little beauty's bite can be fatal.

Just as there are some very large molluscs, there are also a great many that are barely visible to the naked eye. These often go completely unnoticed; a handful of sand taken from an ocean beach and looked at through a microscope, however, will often reveal an infinite variety of these minute molluscs. Some shell collectors find these Lilliputian molluscs so fascinating that they collect them exclusively. But it isn't only shell collectors who pay special attention to micro-molluscs. Some tiny fossil molluscs have been found to be associated with oil deposits. For

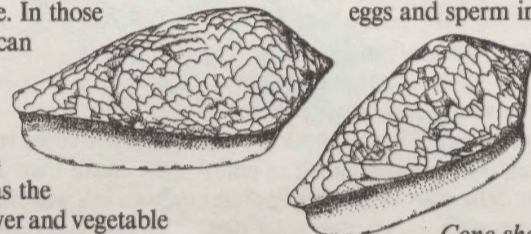
this reason, oil companies hire experts to analyse samples from exploratory bore holes for the presence of these molluscs. If present in large numbers, micro-molluscs indicate high-potential drilling sites.

One feature that characterizes a mollusc is its shell, although not all molluscs have one. In those that do, the shell can be external or internal and very prominent or vestigial. Some land snails, such as the slugs found in flower and vegetable gardens, and some marine molluscs, such as nudibranchs, have either vestigial internal shells or no shell at all. (Nudibranchs are commonly called sea slugs or sea butterflies because of their incredible colours and form of locomotion.)

Cephalopods, better known as squid and octopus, can have external shells, prominent or vestigial internal shells, or no shell at all. Although all octopus lack a true shell, the female of the Argonaut makes a shell in which to cradle and protect her eggs while they develop. She then hugs the shell and its precious cargo using two of her arms to support it, while

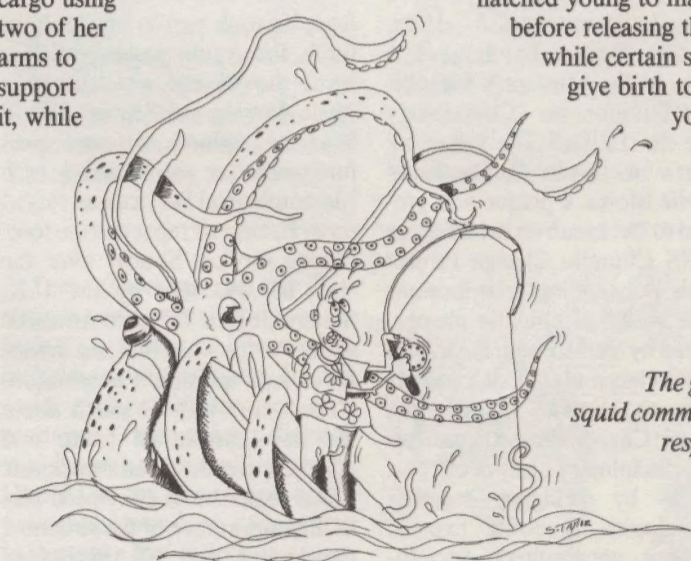
sexes; some, however, have dual sexuality and still others have the ability to change their sex.

Females, depending on what species they are, lay from one to more than 50 million eggs at a time. As a rule, clams produce more eggs than snails do. Some molluscs fertilize their eggs by discharging eggs and sperm into



Cone shells

the water at the same time; in others the sperm is implanted directly into the female. Females produce a wide variety of protective coverings for their eggs. Some species produce strings of leather-like cases. Others produce collar-like masses of eggs mixed with sand, and some produce jelly-like blobs or ribbons, which they attach to seaweeds, floats or even their own shells. There is even a large, tropical land snail that lays eggs that look just like small bird eggs. Some clams hatch their eggs within the safety of their shells, allowing the newly hatched young to mature before releasing them, while certain snails give birth to live young.



The giant squid commands respect!

she floats on the surface of tropical seas, waiting for her eggs to hatch.

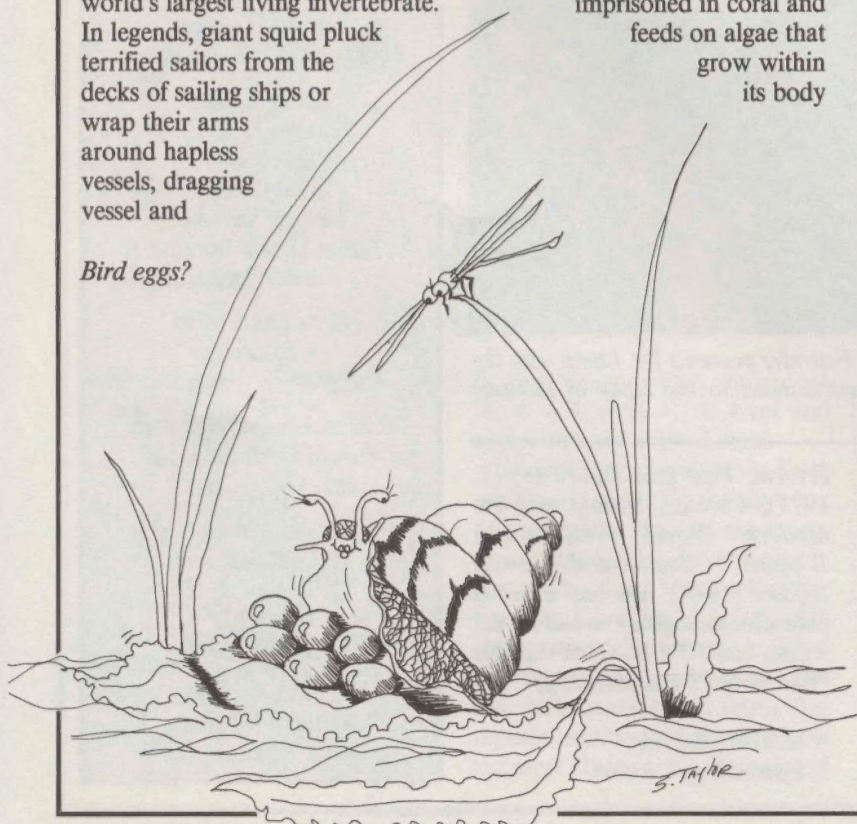
The cuttlefish is a squid with a very prominent internal shell. The "cuttlebone," as it is called, is composed mainly of calcium carbonate. You've probably seen one — they're used to supply captive birds with calcium.

Some molluscs live for only a very short time, in some cases just long enough to reproduce once. Others, such as the giant clam and various freshwater clams, can live for years, reproducing many times. Molluscs generally have separate

Many species of molluscs produce juveniles that look so different from their parents that, in some cases, they were originally named as entirely different species. It was not until the adults were observed with their young that was it realized that they were, in fact, the same species.

Molluscs have played an important role in many cultures down through the ages and continue to do so today. Their uses are almost as diverse as molluscs themselves. Their shells have been

(continued on page 2)



Bird eggs?

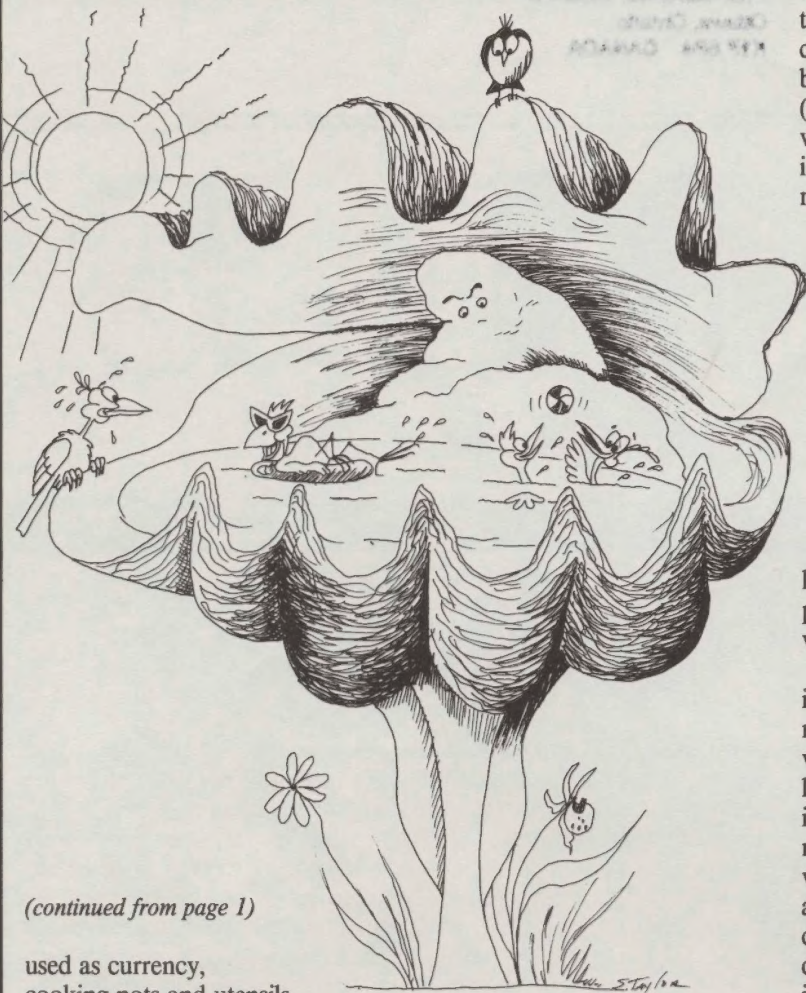
S. Taylor



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(continued from page 1)

used as currency, cooking pots and utensils, buttons, baby baths, bird baths, and baptismal fonts, horns, window panes and objects of personal adornment. Molluscs have always been important as food, whether consumed as gourmet delicacies or as an important component of an everyday diet. Their infinite shapes have been depicted in art and architecture and incorporated into the coats of arms of many families. The scallop's shell was used as the symbol of the pilgrims during the religious crusades; today it is still used as a symbol by the Shell Oil Company. The ancient Romans used various species of marine snails, commonly known as murex or rockshells, to make the famous Tyrian purple

used to dye the robes of their nobility. More than 2000 years before India ink was created, people were using a dark brown liquid pigment known as sepia. Sepia is squid ink and is produced by squid as a form of defence. When threatened, the squid ejects a cloud of ink that confuses the adversary, providing both cover and time to escape.

Natural pearls have been valued since ancient times as symbols of perfection, social status and wealth. In reality they are accidents of nature. Pearls are the result of a normally healthy mollusc's efforts

to protect itself from irritation caused by the intrusion of a foreign body into its sensitive body tissue (called the mantle). The object, whether a grain of sand or a small invertebrate, is covered with mother-of-pearl, which stops the irritation and in the process creates a pearl. Although pearls are usually thought of as being produced only by pearl oysters, other marine and freshwater clams and marine snails can also produce pearls. Pearls are wonderfully lustrous when produced by a mollusc that is naturally lined with mother of pearl. Pearls produced by other kinds of molluscs tend to be duller, more porcelainous, and are often tinted with the colours of their maker.

Molluscs are becoming increasingly important as we discover more about them. They can offer a wide range of sustainable and largely untapped benefits to society if we manage them wisely as a natural resource. Molluscs play a valuable role in medical research, aiding in the discovery of new drugs and techniques to combat disease. They serve as important indicators of the well-being of planet Earth and they are good indicators of water pollution. Fossil molluscs are studied in conjunction with living species, providing scientists with much valuable information about past climates and faunal changes. The development of traditional and new mollusc fisheries could greatly improve the nutritional and economic standards not only of Canadians, but also of the Third World. Ensuring the sustainable development of these fisheries, as well as of other areas molluscs offer resource potential, is an important challenge.

Jane Topping
Zoology Division

On second thought...

From the Director's Desk

Wow! A million and a quarter dollars. That is the amount of the largest single donation so far received in support of the acquisition of the fabulous Pinch collection of minerals. In all, the project has received cash and pledges totalling about \$4,600,000. Our target was \$5,000,000, so we are more than 90% of the way there. This is the first attempt by the National Museum of Natural Sciences to raise a significant amount of money from the private sector. It is also probably the largest amount of money ever raised by any museum in Canada for acquiring a single item or collection. We still need your help in raising the final \$400,000, so send in your donation to this winning project.

Our strategy was in three parts: a campaign aimed at large mining sector corporations; another designed to entice medium and small corporations using a travelling exhibit; and a donor programme where individuals can sponsor minerals in the name of children or grandchildren. Each campaign was handled by geographical region under the advice and assistance of a group of "Trustees" who have been drawn from the ranks of top management of large corporations. The Museum recognized it could not possibly take on the project on its own, especially considering it was the first for the Museum, and the largest such ever mounted in the country. We therefore hired FSN, a fund-raising company from Toronto, to assist us. It was a wise decision and we have learned a great deal from FSN staff.

Success was mainly the result of the enthusiastic response by the Canadian mining sector. We are grateful indeed and I am personally certain that these people have made a contribution to Canada's heritage that will live for centuries. Of course, not all of it was easy. One of the most complex problems involved finding ways to work within the rules of government, which are not set up to allow fund-raising and all the risk-taking and other necessities of fund-raising in the private sector. Permission to undertake the campaign, for instance, was gained only one week before the first payment for the collection had to be made. But new procedures are in place and new understanding of the requirements is building.

The imminent success of the fund-raising programme for the Pinch collection means that we will be preparing plans for a gallery that emphasizes the mineral and geological world, what it contains, how it works, and why it is significant to us. We will also be preparing travelling exhibits to tour the country and are planning a programme of satellite exhibition centres across the country in cooperation with existing museums or private corporations.

I am anxious to hear your ideas on how you would like to see these materials displayed, and what you would like to know about the mineral and geological world — our planet Earth. Please write to me with your ideas.

Alan R. Emery
Director

The Father of Paleoclimatology

On September 22, 1988, Dr. Hubert Lamb gave a lecture at the Museum's Paleobiology Division on "Climatology Since the 1930s." The following day, at a function for Dr. Lamb and his wife Moira, a plaque was presented to Dr. Lamb on behalf of the NMNS Climatic Change Project for his outstanding contributions to the study of climatic change. Created by the Museum in 1977 to better understand Canada's vulnerability to climatic change, the Climatic Change Project stimulates multi-disciplinary study of our past climate by bringing together climatologists, tree-ring experts, historians, geographers, glaciologists, biologists and others. Dr. Lamb has maintained an interest in the Climatic Change Project since its inception, and provided many useful suggestions for the international symposium "The Year Without a Summer? Climate in 1816," held at the Museum June 25-28, 1988. Some highlights of Dr. Lamb's interesting and productive career follow.

Hubert Horace Lamb was born on September 22, 1913 and graduated in 1935. His career in meteorology began with research aimed at understanding North Sea

fogs. He took part in preparations for the first regular passenger flights across the Atlantic, which began in 1939. During the Second World War he trained meteorological forecasters for the fledgling Irish Meteorological Service and stayed on in Ireland to supervise the forecasting service. Shortly after the war, he was sent by the U.K. Meteorological Office to Antarctic waters to provide forecast advice for whale-spotting amphibious aircraft, and learned much about the development of fronts and cyclones over the Southern Ocean. These experiences convinced him of the importance of the structure, movements and life history of weather systems.

He led the climatic variation research at the U.K. Meteorological Office and was able to broaden his work through an invitation from the University of East Anglia to set up the Climatic Research Unit there in 1971. He became honorary professor in the School of Environmental Science at East Anglia, and is presently Emeritus Professor at the Climatic Research Unit. Recently, he was awarded an honorary doctorate by the University of Cambridge.

His main aim has been to build a



Museum Deputy Director Jacques Fournier presents Dr. Lamb with the NMNS award for outstanding contributions to the study of climatic change.

detailed picture of the climates of the past and to acquire sufficient understanding of them to be able to see how climate might develop. By examining proxy records, he has been able to reconstruct much of the climate of the last two or three hundred years. He is noted for having published the results of his extensive research in such books as the two-volume *Climate: Present, Past and Future* (1972, 1977); *Climate, History and the Modern World* (1982) and *Weather, Climate and Human Affairs* (1988). He has inspired paleoclimatologists around the world, and fully deserves the title "Father of Paleoclimatology."

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C.R. Harington
Paleobiology Division

BIOME

Editor-in-Chief:
Nick Bélanger

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Sandra Taylor

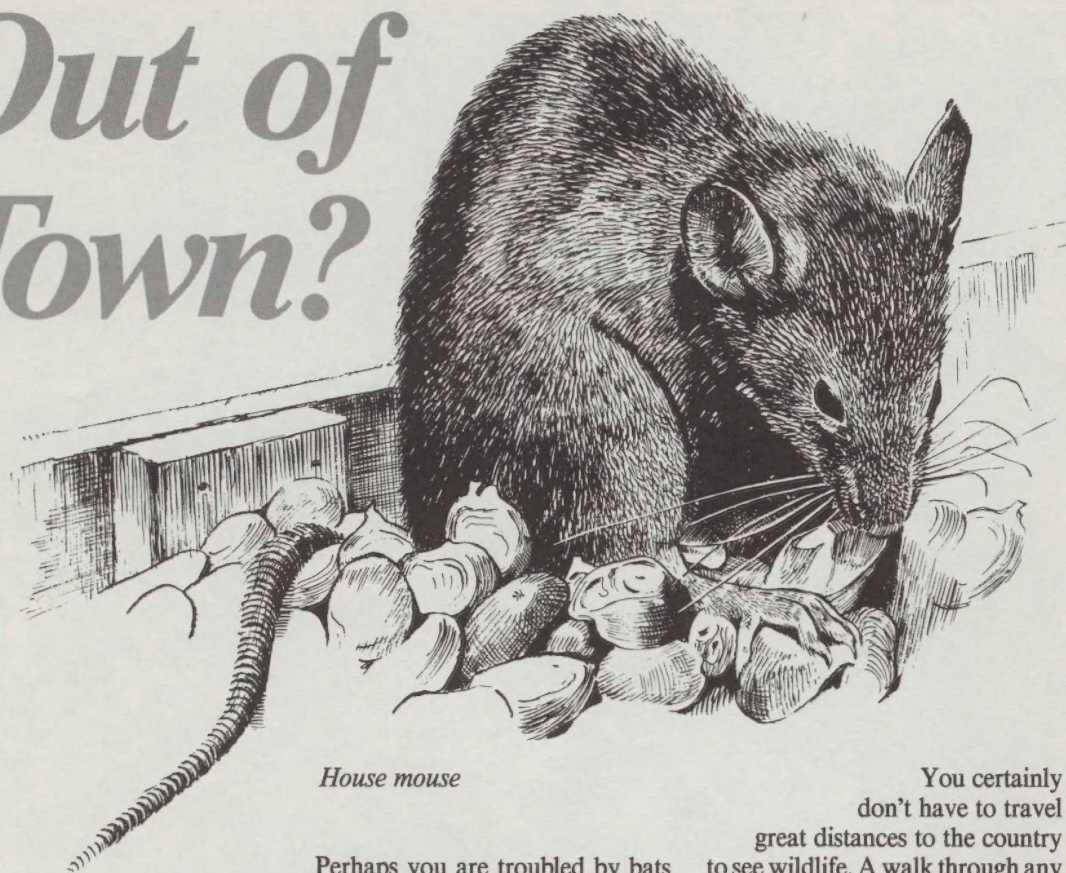
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BIOME
National Museum of
Natural Sciences
P.O. Box 3443
Station D
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K1P 6P4

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Out of Town?



House mouse

Two new travelling exhibits:

Wild in the City

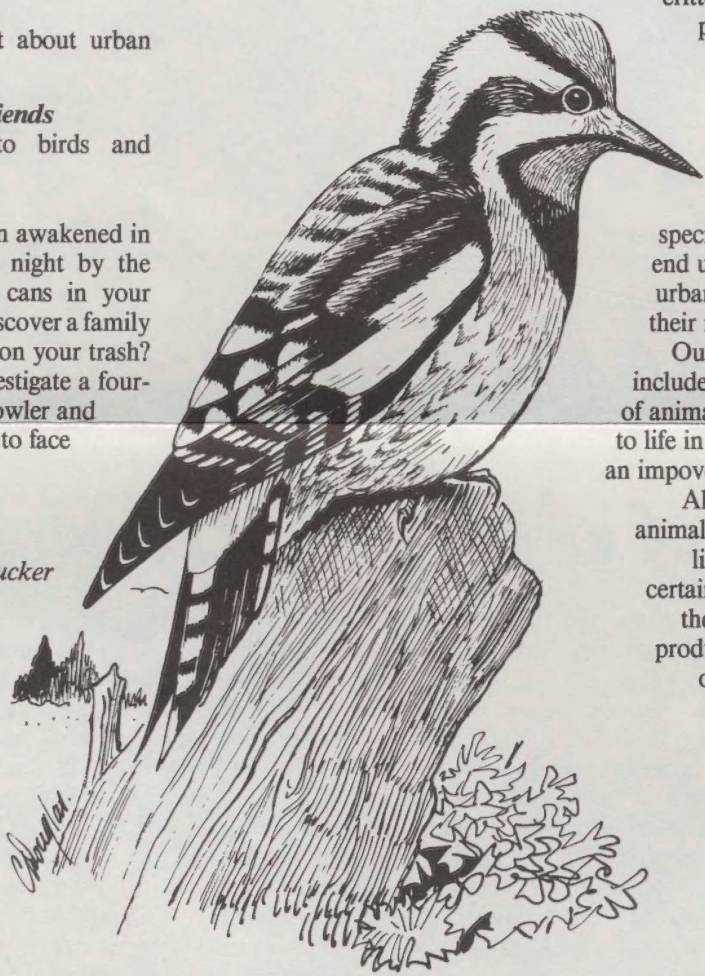
a travelling exhibit about urban wildlife

Our Feathered Friends

an introduction to birds and birdwatching

Have you ever been awakened in the middle of the night by the clatter of garbage cans in your driveway only to discover a family of raccoons dining on your trash? Or gone out to investigate a four-footed midnight prowler and found yourself face to face with a skunk?

Yellow-bellied Sapsucker



You certainly don't have to travel great distances to the country to see wildlife. A walk through any city or large town will bring you into contact with an impressive variety of animals. Certain city critters, such as mice and pigeons, have lived in and around human settlements for centuries and actually thrive on their contact with people. Other species, such as raccoons, end up in the city because urban sprawl has invaded their natural habitats.

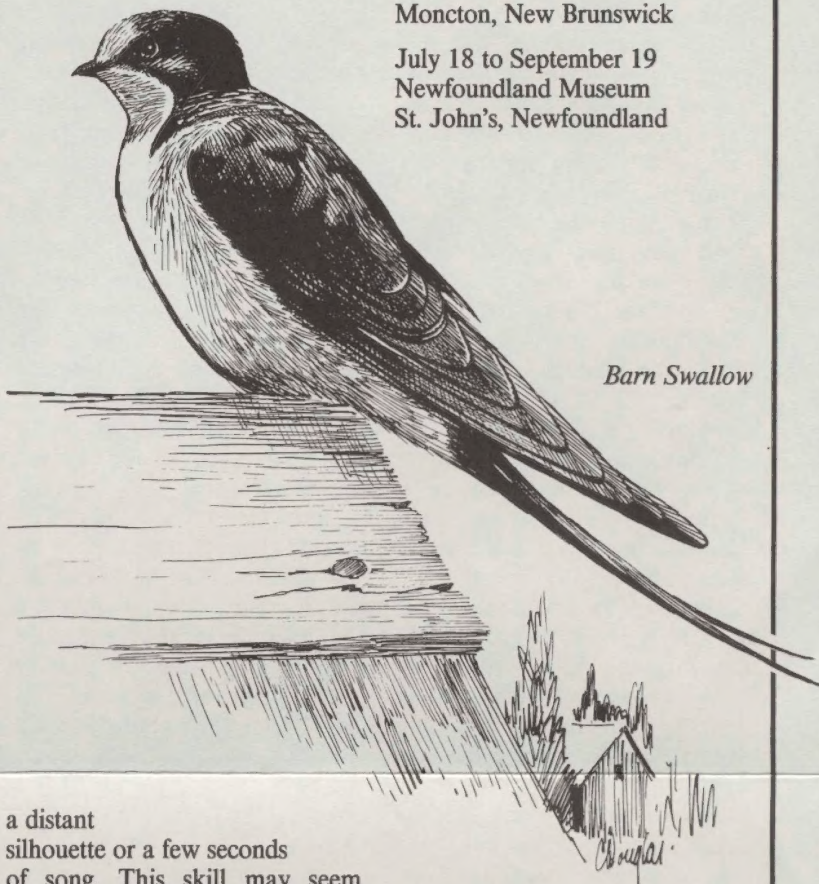
Our urban communities include an amazing number of animals that have adapted to life in what many consider an impoverished environment.

Although each of these animals has a very different lifestyle, they all share certain talents for survival; they scavenge for food, produce large numbers of offspring, and possess an impressive ability to take advantage of the city's resources.

Wild in the City, a new exhibit produced by the National Museum of Natural Sciences, introduces a few of the more common birds and mammals you are likely to meet in city parks, town lots and backyards across the country.

Birds are some of the more conspicuous urban animals and are the subject of a second new exhibit, *Our Feathered Friends*. About 578 species of birds are found in Canada and its coastal waters, and birdwatching has become a favourite pastime for millions of Canadians.

Experienced birdwatchers can recognize any one of hundreds of species of birds given no more than



Barn Swallow

a distant silhouette or a few seconds of song. This skill may seem bewildering, but it is simply the result of careful observation.

Our Feathered Friends will help you take the first steps in discovering the world of birds. The exhibit explains how to identify birds, step by step, and provides tips on how to attract birds to your own backyard, one of the best places to begin birdwatching. It takes a closer look at that unique characteristic of all birds — feathers — and examines how these animals have evolved into efficient flying machines.

Wild in the City and *Our Feathered Friends* will be travelling throughout Canada for the next five years. Look for them at:

Wild in the City

May 9 to July 4
Société astronomique de Dolbeau
Dolbeau, Quebec

July 18 to September 19
Kerry Wood Nature Centre
Red Deer, Alberta

October 3 to November 28
Police Point Interpretive Centre
Medicine Hat, Alberta

Our Feathered Friends

May 5 to July 4
Moncton Museum
Moncton, New Brunswick

July 18 to September 19
Newfoundland Museum
St. John's, Newfoundland

October 3 to November 28
Aiken Bicentennial
Exhibition Centre
Saint John, New Brunswick

Or check with your local museum, library, or gallery for information about NMNS exhibits that may be coming to your area.

Joanne Sparks
Exhibits Division

Off the Press

Identification Guide to the Trees of Canada

Jean Lauriault

458 pp. Black-and-white illustrations
ISBN 0-88902-564-9
18 x 25.5 cm
\$24.95 (PB)

Édition française:

Guide d'identification des arbres du Canada

ISBN 2-89000-182-2

Because dichotomous keys can be complicated, traditional identi-

fication guides often discourage those who wish to discover and enjoy the trees around them.

Identification Guide to the Trees of Canada, unlike other guides, has an easy-to-use though unconventional approach. In this book, written by Jean Lauriault of the Exhibits Division, all trees with similar visual features are grouped together regardless of genus. The four leaf-identification tables that replace traditional keys deal with the most obvious characteristics of

a leaf: its arrangement on a twig, its shape, its margins and its veins. Hundreds of drawings illustrate variations in leaves of the same species and also illustrate twigs, flowers, fruits, barks and tree silhouettes, which help to differentiate one species from another. The book describes some of the more frequently encountered ornamentals that are not native to Canada.



Betula cordifolia

Texts accompanying the illustrations and distribution maps contain a wealth of information, including origins of Latin, English and French names, historical data, economic importance, diseases, toxicity and medicinal properties. Useful tips for tree-related activities are also provided, such as how to start up a leaf collection or herbarium and how to determine the age of a tree.

Co-published with Fitzhenry & Whiteside Ltd., *Identification Guide to the Trees of Canada* is available in bookstores nationwide.

And Something for Free!

Imagine what it would be like to go backward in time, back to the days when there was no life on earth, or even before then, when neither the earth nor the solar system existed. It would require a journey through six billion years; a journey that you can take by



Pinus strobus L.

reading *Life Through the Ages*. This new issue of *Neotoma* written by Mary Anne Dancy of the Education Division highlights the process of evolution from the formation of our solar system to the last two million years. Call or write the Museum Resource Centre for your free copy of *Neotoma* no. 22, *Life Through the Ages*. A list of our other free materials is also available upon request.

Birdwatching with a Prejudice



(adapted from an article first published in *Trail & Landscape* 21:141-143)

It is fashionable among some bird lovers to denounce such birds as the European Starling (*Sturnus vulgaris*), the House Sparrow (*Passer domesticus*) and the Rock Dove (*Columba livia*). These birds are guilty of being ubiquitous in human habitats and of having been introduced into the New World.

There is no shortage of anthropomorphic adjectives to describe the starling: aggressive, dirty, cacophonous, ugly and worst of all — the unpardonable sin — “intelligent.” All of these alleged flaws can be found in many other species native to Canada, and yet we do not find these birds offensive. The starling is different because it was introduced into Canada; this is its true crime.

However, we should realize that it is really the bird's habitat that was imported with European colonization: habitat that is expanding daily, and without which starling populations would be limited to their simplest terms. Anthropogenic habitats, those modified by humans, provide optimum living conditions for several bird species. These species have adapted to cultivated fields, buildings and frequent disturbances. When it arrived in North America, the starling settled and prospered in the ecological niche that it had

occupied for thousands of years in the Old World.

European Starlings were beginning to occupy new territories, including such far-flung places as Iceland and the Azores, before the species was introduced in North America. The first sighting of a starling in the wild in Canada was on the coast of Labrador in 1878, coinciding with an invasion of the species into Iceland. This was 12 years before it was first introduced in New York City in 1890, and 36 years before starlings from New York spread into Ontario in 1914. Today, the European Starling is still among the migratory European passerine birds recorded at the Alpha Marine Station, halfway between Iceland and Greenland.

Given the creation and expansion of its habitat, we can easily say that if the starling had not been introduced into North America, it would have established itself here sooner or later, as have many other species before and after it. Only those species brought by humans into regions that they could not have reached by themselves can really be called “introduced” species.

Prejudiced bird-watchers notwithstanding, the European Starling is a bona fide participant in North American bird life.

Michel Gosselin
Zoology Division

Baragwanathia longifolia, NMNS specimen PB01542 from Victoria, Australia.

The Oldest Land Plant?

Just a little more than 50 years ago, a remarkable discovery was made in the State of Victoria, southeastern Australia.

In 1935 two botanists, Dr. Isabel Cookson from the University of Melbourne in Victoria and Dr. William Lang from the University of Manchester, Great Britain, identified and described an unusually well-preserved plant macrofossil. The macrofossil was found in several localities near Yea, Victoria, a small town about 70 km north of Melbourne. Because of its geological age, Drs. Cookson and Lang were immediately aware of the significance of this fossil plant, which they named *Baragwanathia longifolia*. *Baragwanathia* and several other primitive-looking fossil plants were recovered from rock beds associated with marine organisms that dated as far back as 410 million years.

At the time of its initial description, *Baragwanathia* represented the remains of the world's earliest vascular land plants. Vascular land plants have water-conducting vessels throughout their stems, thus allowing the plant to root within soil layers and stand erect. Nearly all of the land plants that we see today — our trees, shrubs and even grasses — are vascular plants. *Baragwanathia* provided evidence that 410 million years ago vascular land plants were already present as part of the Earth's flora.

Baragwanathia, named in honour of Dr. Baragwanth, a geologist working for the Geological Survey of Victoria, is a distant relative of our present-day lycopods or club mosses. The stems, often branching, reach lengths of 10 cm to 20 cm in some specimens. The leaves are thin and needle-like, covering the stem in a dense, hairy manner. The fossils frequently show the reproductive organs or sporangia, and sections of the stem reveal the vascular tissue characteristic of land plants.

While I was in Australia in 1987, I had the opportunity to visit with Dr. Jack Douglas, Senior Geologist with the Geological Survey of Victoria. Dr. Douglas is an experienced geologist whose knowledge of the geology and paleobotany of Australia, especially of Victoria, is perhaps unmatched. My short visit to discuss matters of mutual interest culminated in the presentation of a gift to the National Museum of Natural Sciences — a fine specimen of *Baragwanathia longifolia* (see illustration). Needless to say, I was very pleased and carried our “newest” and “oldest” donation home with me on the plane.

Since it was first described by Lang and Cookson, *Baragwanathia* has been the object of considerable discussion and speculation. At the time of its discovery, the rock layers containing this land plant were considered to be of Upper Silurian

age, or about 400 to 415 million years old. However, further investigations on the age of associated organisms suggested that the rock layers could be somewhat younger, about 395 million years old. This slight age difference may not seem that significant, but it may be enough to deprive *Baragwanathia* the distinction of being the oldest known land plant; other plants presumed to be older have since been discovered. The debate continues, although most recent paleobotanical textbooks tend to favour the Upper Silurian age for *Baragwanathia*.

In 1961, paleobotanists from the Geological Survey of Canada and the Smithsonian Institution in Washington, D.C., discovered what may be considered the finest detailed specimens of the genus, in rock layers exposed along the Abitibi River, James Bay Lowland, Ontario. Their specimens, identified as a new species, were dated clearly as Early Devonian (about 395 million years old), younger than their Australian relatives. *Baragwanathia* and other early plant floras in Australia, Canada, Europe, the United States and Siberia provide evidence that land plants with “advanced” complex structures inhabited our planet as early as 415 million years ago.

David M. Jarzen
Paleobiology Division



National Museum of Canada

Kierran Shepard, Paleobiology Division